Docket 87209JDP
Customer No. 01333

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of

Aaron T. Deever

IMAGE COMPRESSION UTILIZING DISCARDING OF BITPLANES

Serial No. 10/748,935

Filed 30 December 2003

Group Art Unit: 2624

Examiner: Stephen R. Koziol

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA. 22313-1450

Sir:

APPEAL BRIEF PURSUANT TO 37 C.F.R. 41.37 and 35 U.S.C. 134

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APPELLANT'S BRIEF ON APPEAL

Appellant hereby appeals to the Board of Patent Appeals and Interferences from the Examiner's Final Rejection of claims 1-23, which was contained in the Office Action mailed August 22, 2007.

A timely Notice of Appeal was filed December 26, 2007.

Real Party In Interest

Eastman Kodak Company is the real party in interest.

Related Appeals And Interferences

No appeals or interferences are known which will directly affect or be directly affected by or have bearing on the Board's decision in the pending appeal.

Status Of The Claims

Status of claims that were ever in the case is as follows:

Claims 1-23 are pending in the application.

Claims 1-23 are being appealed.

Appendix I provides a clean, double spaced copy of the claims on appeal.

Status Of Amendments

An Amendment After Final was filed on October 26, 2007, subsequent to the Final Rejection. An Advisory Action dated November 14, 2007 was received entering the proposed amendment but not allowing the claims. A Pre-Appeal Brief Request for Review was then filed by Appellant with a Notice of Appeal on December 26, 2007. A Notice of Panel Decision from Pre-Appeal Brief Review dated March 24, 2008 was then received which included a recommendation that Appellant proceed with the instant Appeal.

Summary of Claimed Subject Matter

Independent Claim 1 requires:

A method for encoding digital image data, said method comprising the steps of: defining a base image type and a plurality of higher level image types of said digital image data, each said image type having a preassigned one of a plurality of quantization step-size sets (e.g., pg 12, lines 23-26; pg 24, lines 23-25; Fig 13, ref. 1405); transforming the digital image data using a subband decomposition to produce a plurality of subbands, each said subband having a plurality of subband coefficients (e.g., pg 13, lines 8-11; pg 15, lines 24-28; pg 27, lines 16-18; Fig 4, ref 402; Fig 13, ref. 1402); quantizing said subband coefficients of each said subband according to said quantization step-size set of said base image type to provide quantized coefficients (e.g., pg 24, lines 23-25; Fig 13, ref. 1404); partitioning each said subband into a plurality of codeblocks (e.g., pg 24, lines 25-27; Fig 13, ref. 1407); assigning each said codeblocks one of said image types and a corresponding quantization step-size set to provide respective assigned step-size sets (e.g., pg 15, lines 2-4; pg 24, lines 28-30; Fig 13, ref. 1409); forming one or more bitplanes from said quantized coefficients of each said codeblock of each said subband (e.g., pg 14, lines 33-16); and discarding at least part of one of said bitplanes having a discard parameter in a predetermined range, said discard parameter being a function of the assigned step-size set of the respective said codeblock (e.g., pg 44, line 30 to pg 15, line 14; pg 19, lines 17-21; Fig 7, refs. 411, 704).

Independent Claim 16 requires:

A computer program product for encoding digital image data representing a plurality of pixels, said product comprising: a computer readable storage medium having a computer program stored thereon for performing the steps of: defining a base image type and a plurality of higher level image types of said digital image data, each said image type having a preassigned one of a plurality of quantization step-size sets (e.g., pg 12, lines 23-26; pg 24, lines 23-25; Fig 13, ref. 1405); transforming the digital image data using a subband decomposition to produce a plurality of subbands, each said subband having a plurality of subband coefficients (e.g., pg 13, lines 8-11; pg 15, lines 24-28; pg 27, lines 16-18; Fig 4, ref 402; Fig 13, ref. 1402); quantizing said subband coefficients of each said subband according to said quantization step-size set of said base image type to provide quantized coefficients (e.g., pg 24, lines 23-25; Fig 13, ref. 1404);

partitioning each said subband into a plurality of codeblocks (e.g., pg 24, lines 25-27; Fig 13, ref. 1407); assigning each said codeblocks one of said image types and a corresponding quantization step-size set to provide respective assigned step-size sets (e.g., pg 15, lines 2-4; pg 24, lines 28-30; Fig 13, ref. 1409); forming one or more bitplanes from said quantized coefficients of each said codeblock of each said subband (e.g., pg 14, lines 33-16); and discarding at least part of one of said bitplanes having a discard parameter in a predetermined range, said discard parameters each being a function of the assigned step-size set of the respective said codeblock (e.g., pg 44, line 30 to pg 15, line 14; pg 19, lines 17-21; Fig 7, refs. 411, 704).

Independent Claim 17 requires:

An image encoder for encoding digital image data representing a plurality of pixels, said encoder comprising: an image typer, which determines a base image type and a plurality of higher level image types of said digital image data, each said image type having a preassigned one of a plurality of quantization step-size sets (e.g., pg 12, lines 23-26; pg 24, lines 23-25; Fig 13, ref. 1405); a transform unit applying a subband decomposition to said digital image data, said transform unit outputting a plurality of subbands, each said subband having a plurality of subband coefficients (e.g., pg 13, lines 8-11; pg 15, lines 24-28; pg 27, lines 16-18; Fig 4, ref 402; Fig 13, ref. 1402); uniform quantizer having a deadzone, said quantizer quantizing said subband coefficients according to said quantization step-size set of said base image type to provide quantized coefficients (e.g., pg 24, lines 23-25; Fig 13, ref. 1404); a codeblock partitioning unit partitioning each said subband into a plurality of codeblocks (e.g., pg 24, lines 25-27; Fig 13, ref. 1407); a classification unit assigning each said codeblocks one of said image types and a corresponding quantization step-size set to provide respective assigned step-size sets (e.g., pg 15, lines 2-4; pg 24, lines 28-30; Fig 13, ref. 1409); an encoder forming one or more partial-bitplanes from said quantized coefficients and encoding respective said coefficients (e.g., pg 14, lines 33-16); and a discard unit identifying discardable partial-biplanes, at least one of said partial-bitplanes having a discard parameter in a predetermined range, said discard parameters each being a function of the assigned step-size set of the respective said codeblock (e.g., pg 44, line 30 to pg 15, line 14; pg 19, lines 17-21; Fig 7, refs. 411, 704).

Grounds of Rejection to be Reviewed on Appeal

The following issues are presented for review by the Board of Patent Appeals and Interferences:

1. Claims 1, 3, 9-10, 16-17, and 19-22 rejected under 35 U.S.C. §102(e) as being anticipated by Joshi et al. (U.S. Patent 6,668,090 B1).
2. Claims 2, 4-8, 11-15, 18, and 23 rejected under 35 U.S.C. §103(a) as being unpatentable over Joshi et al. (U.S. Patent 6,668,090 B1).

Arguments

1. The rejection of Claims 1, 3, 9-10, 16-17, and 19-22 under 35 U.S.C. §102(e) as being anticipated by Joshi et al. (U.S. Patent 6,668,090 B1).

Claims 1, 3, 9-10, 16-17, and 19-22 stand rejected under 35 U.S.C. §102(e) as allegedly anticipated over U.S. Patent No. 6,668,090 (Joshi et al.). Appellant respectfully submits that the claims are patentable over the rejecting reference for at least the following reasons.

In Appellant's response dated August 3, 2007, Appellant pointed out that Independent Claim 1 requires, among other things, "assigning each said codeblocks one of said image types", "each said image type having a preassigned one of a plurality of quantization step-size sets." Appellant stated that the Joshi et al. Patent is not understood to teach or suggest a linking between (a) codeblock and image type, and (b) image type and quantization step-size set, as required by Claim 1. Appellant reasoned that:

> "In fact, the Joshi et al. Patent appears not to discuss image type at all in this regard. For example, the Joshi et al. Patent states that '[e]ach codeblock is compressed by the codeblock compression unit (206) using the appropriate quantizer step-size (209) ....' Col. 5, lines 27-29. However, the Joshi et al. Patent has not been found to teach or suggest that its 'appropriate quantizer step-size' is selected based on an image type assigned to the respective codeblock, as required by Claim 1."

The final Office Action dated August 22, 2007 disagreed with Appellant and alleged that the Joshi et al. Patent:

> "teaches and certainly suggests in col. 5 ln. 12-55 (a) a link between codeblock and image type (see fig 2 items 204-211, also col. 5, ln. 31-42, where criteria such as visual quality levels and viewing condition parameters link each codeblock with its desired image type) and (b) image type and quantization step-size set (see fig. 2 items, also, col. 5, ln. 27-42, where for each codeblock, an 'appropriate quantizer step is chosen (col. 5, ln 29)' which is based on the image type criteria associated with each codeblock (col. 5, ln. 31-42)." See pages 8-9 of the Final Office Action.

In this regard, Appellant respectfully submits that the Examiner has unfairly interpreted the Joshi et al. Patent. In particular, the final Office Action refers to visual quality levels and viewing condition parameters, which the Joshi et al. Patent describes as pertaining to its step 212. See FIG. 2 (showing "visual quality table (210)" and "viewing condition parameters (211)" being input into step 212). On the other hand, the final Office Action refers to the Joshi et al. Patent's use of an 'appropriate quantizer step-size (209)' during its step 206. See Col. 5, lines 27-30. The final Office Action then implies (without support from the Joshi et al. Patent) that the 'appropriate quantizier step-size' used in step 206 is based on the visual quality levels and viewing condition parameters later used in step 212. See page 9, lines 1-5 of the final Office Action (stating that "where for each codeblock, an appropriate quantizer size is chosen' (col. 5, ln. 29) which is based on the image type criteria associated with each codeblock (col. 5, ln. 31-42).").

This implication (pg. 9, lines 1-5 of the Office Action referred to immediately above) has not been found to be supported by the Joshi et al. Patent. **In particular, Appellant has not found any teaching or suggestion in the Joshi et al. Patent that the visual quality table 210 and/or viewing condition parameters 211, used in step 212, have anything to do with step 206's using of an "appropriate quantizer step-size (209)".** Accordingly, Appellant respectfully submits that the Office Action has improperly interpreted the Joshi et al. Patent and, thus, has not shown that the Joshi et al. Patent teaches or suggests at least Claim 1's requirements of "each said image type having a preassigned one of a plurality of quantization step-size sets" and "assigning each said codeblocks one of said image types and a corresponding quantization step-size set".

Further, the final Office Action appears to have read the word "chosen" into step 206 of the Joshi et al. Patent. See page 9, line 3 of the final Office Action ("an 'appropriate quantizer step size is chosen (col. 5, ln. 29)'"). However, col. 5, line 29 actually states "using the appropriate quantizer step-size (209)". Accordingly, there does not appear to be any choosing of an appropriate quantizer step-size for codeblocks in step 206 based on a codeblock's image type, as suggested by the final Office Action. Appellant made this point in his response dated August 3, 2007 and stated that "the Joshi et al. Patent has not been found to teach or suggest that its 'appropriate quantizer step-size' is selected based on an image type assigned to the respective codeblock, as required by Claim 1." The mere statement that an "appropriate quantizer step-size" is used does not mean that each codeblock is assigned an image type and a corresponding quantization step-size set, as required by Claim 1.

The Advisory Action mailed November 14, 2007 does not address any of Appellant's above-remarks.

None of the other rejecting references are cited as teaching or suggesting the above-discussed features of Claim 1. For at least these reasons, Appellant respectfully submits that Claim 1 is patentable.

Independent Claims 16 and 17 include the same or similar features as those discussed above in connection with Claim 1 and, therefore, are submitted to be patentable for at least the same reasons.

The other claims 3, 9-10, and 19-22 included in this rejection depend from one of the independent claims discussed above and, therefore, also are submitted to be patentable for at least the same reasons.

For at least the above-discussed reasons, Appellant respectfully requests reversal of the 35 U.S.C. § 102(e) rejection of these claims.

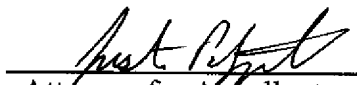
2. The rejection of Claims 2, 4-8, 11-15, 18, and 23 under 35 U.S.C. §103(a) as being unpatentable over Joshi et al. (U.S. Patent 6,668,090 B1).

Claims 2, 4-8, 11-15, 18, and 23 depend from one of the independent claims discussed above and, therefore, also are submitted to be patentable for at least the same reasons. Accordingly, Appellant respectfully requests reversal of the 35 U.S.C. § 103(a) rejection of these claims.

Conclusion

For at least the above-discussed reasons, Appellant respectfully requests that the Board of Patent Appeals and Interferences reverse the rejections made by the Examiner and mandate the allowance of Claims 1-23.

Respectfully submitted,



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Enclosures

If the Examiner is unable to reach the Appellant Attorney at the telephone number provided, the Examiner is requested to communicate with Eastman Kodak Company Patent Operations at (585) 477-4656.

Appendix I - Claims on Appeal

1. A method for encoding digital image data, said method comprising the steps of:

defining a base image type and a plurality of higher level image types of said digital image data, each said image type having a preassigned one of a plurality of quantization step-size sets;

transforming the digital image data using a subband decomposition to produce a plurality of subbands, each said subband having a plurality of subband coefficients;

quantizing said subband coefficients of each said subband according to said quantization step-size set of said base image type to provide quantized coefficients;

partitioning each said subband into a plurality of codeblocks;

assigning each said codeblocks one of said image types and a corresponding quantization step-size set to provide respective assigned step-size sets;

forming one or more bitplanes from said quantized coefficients of each said codeblock of each said subband; and

discarding at least part of one of said bitplanes having a discard parameter in a predetermined range, said discard parameter being a function of the assigned step-size set of the respective said codeblock.

2. The method of claim 1 wherein said base image type is preassigned the smallest of said quantization step-size sets.

3. The method of claim 1 further comprising encoding said quantized coefficients of each of said codeblocks.

4. The method of claim 3 wherein said discarding is prior to said encoding.

5. The method of claim 3 wherein said discarding follows completion of said encoding.

6. The method of claim 1 wherein:

said digital image data has a plurality of initial pixels, each said initial pixel having a predefined coordinate;

said method further comprises associating a respective one of said image types with each of said coordinates and defining ones of said coordinates contributing to each of said codeblocks; and

said discard parameters are each a function of the respective said images types associated with ones of said coordinates contributing to respective said codeblocks.

7. The method of claim 6 wherein said transforming defines a mapping of said coordinates into a plurality of influence regions; and said method further comprises selecting an image type, in each said influence region, having the corresponding said quantization step-size set of smallest magnitude.

8. The method of claim 7 wherein:

said subband coefficients define a plurality of resultant pixels, said resultant pixels each having a respective one of said coordinates; and

said mapping further comprises designating ones of said resultant pixels contributed to by respective said subband coefficients.

9. The method of claim 1 further comprising:

encoding said quantized coefficients of each of said codeblocks in a plurality of coding passes, each said coding pass generating a partial-bitplane, said partial-bitplanes of each said codeblock together defining a respective bitplane; and

said discarding further comprises discarding at least one partial-bitplane.

10. The method of claim 9 wherein said encoding further comprises entropy encoding.

11. The method of claim 9 wherein said encoding further comprises binary arithmetic encoding.

12. (Original) The method of claim 1 wherein the assigned step-size is Δ_j^I , the base type quantizer step-size is Δ_j^B , and the number of bitplanes discarded is $\left\lfloor \log_2 \frac{\Delta_j^I}{\Delta_j^B} \right\rfloor$.

13. The method of claim 12 wherein $\Delta_j^B = 1$.

14. The method of claim 1 further comprising modifying said subband coefficients prior to said quantizing.

15. The method of claim 1 further comprising shrinking said subband coefficients prior to said quantizing.

16. A computer program product for encoding digital image data representing a plurality of pixels, said product comprising: a computer readable storage medium having a computer program stored thereon for performing the steps of:

defining a base image type and a plurality of higher level image types of said digital image data, each said image type having a preassigned one of a plurality of quantization step-size sets;

transforming the digital image data using a subband decomposition to produce a plurality of subbands, each said subband having a plurality of subband coefficients;

quantizing said subband coefficients of each said subband according to said quantization step-size set of said base image type to provide quantized coefficients;

partitioning each said subband into a plurality of codeblocks;

assigning each said codeblocks one of said image types and a corresponding quantization step-size set to provide respective assigned step-size sets;

forming one or more bitplanes from said quantized coefficients of each said codeblock of each said subband; and

discarding at least part of one of said bitplanes having a discard parameter in a predetermined range, said discard parameters each being a function of the assigned step-size set of the respective said codeblock.

17. An image encoder for encoding digital image data representing a plurality of pixels, said encoder comprising:

an image typer, which determines a base image type and a plurality of higher level image types of said digital image data, each said image type having a preassigned one of a plurality of quantization step-size sets;

a transform unit applying a subband decomposition to said digital image data, said transform unit outputting a plurality of subbands, each said subband having a plurality of subband coefficients;

uniform quantizer having a deadzone, said quantizer quantizing said subband coefficients according to said quantization step-size set of said base image type to provide quantized coefficients;

a codeblock partitioning unit partitioning each said subband into a plurality of codeblocks;

a classification unit assigning each said codeblocks one of said image types and a corresponding quantization step-size set to provide respective assigned step-size sets;

an encoder forming one or more partial-bitplanes from said quantized coefficients and encoding respective said coefficients; and

a discard unit identifying discardable partial-biplanes, at least one of said partial-bitplanes having a discard parameter in a predetermined range, said discard parameters each being a function of the assigned step-size set of the respective said codeblock.

18. The image encoder of claim 17 wherein said base image type is preassigned the smallest of said quantization step-size sets.

19. The image encoder of claim 17 wherein said discard unit communicates said discardable partial-bitplanes to said encoder and said encoder excludes said discardable partial-bitplanes from said encoding.

20. The image encoder of claim 17 further comprising a bit-stream organizer combining said partial-bitplanes into a bit-stream.

21. The image encoder of claim 20 wherein said encoder forms said partial-bitplanes from said quantized coefficients of each said codeblock of each said subband and encodes all of said coefficients; and said discard unit

communicates said discardable partial-bitplanes to said bit-stream organizer, which excludes said discardable partial-bitplanes from said bit-stream.

22. The image encoder of claim 17 wherein said encoder is an entropy encoder.

23. The image encoder of claim 17 wherein said encoder is an arithmetic binary encoder.

Appendix II - Evidence

None

Appendix III – Related Proceedings

None